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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the Application of:	]
HERVE LESCUYER et al	]Attorney Docket: 01115
Serial No: 09/856,460	]Group Art Unit: 1723
Filed: August 7, 2001	]Examiner: K. S. Menon
For: IMPROVED METHOD FOR FILTERING A METAL LIQUID ON A BED OF REFRACTORY PARTICULATE MATERIAL	]MAIL STOP APPEAL BRIEF-PATENTS

Appeal No:_____

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

APPELLANTS' SECOND SUPPLEMENTAL BRIEF ON APPEAL

Appellants now appeal from the Final Office Action mailed on November 10, 2004. A Notice of Appeal with the appropriate fee was filed on April 1, 2004, and an Appeal Brief with the appropriate fee was filed on June 1, 2004.

I. REAL PARTY IN INTEREST

The real parties in interest are the assignees, Aluminium Pechiney and Pechiney Rhenalu, and parent company Pechiney (ALCAN Group).

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

Claims 1-7, 9 and 11 are in this application; claims 8 and 10 have been canceled.

Claims 1-7, 9 and 11 stand rejected.

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IV. STATUS OF AMENDMENTS

There are no unentered amendments.

V. SUMMARY OF INVENTION

The invention is directed to a method for filtration of liquid metal comprising passing the liquid metal through a bed of refractory particulate material having an open porosity of between 5 and 30% (page 2, lines 12-15).

The porosity of the particulate material is recited as "open" porosity, defined in the specification at page 2, lines 18-21, as the porous volumes of the grains of the bed (surface porosities and internal porosities). The grains of the bed thus have pores which are open to flow of liquid metal, as opposed to hollow grains which might be closed. As further stated at page 2, lines 21-22 of the specification, this porosity is essentially due to pores of a diameter greater than 10 μm (claim 3), and the particle size is generally between 0.2 and 20 mm and the bed has a thickness between 4 and 40 cm (claim 4; page 2, lines 24-25).

The preferred filtration bed of the invention is alumina, particularly electrofused corundum (claim 5; page 3, lines 8-9), and the invention enables superior purification with residence times equivalent to tabular alumina beds with an open porosity generally less than about 3% as a result of pores of size less than about 10 μm, as discussed in the specification on page 2, line 25 through page 3, line 5.

The invention enables consistent removal of inclusions at a rate of at least 95%, and possibly greater than 97% (page 3, lines 20-21), and enables a reduction of residence time in the bed while maintaining a quality level at least equal to, or greater than, other particulate materials (page 3, lines 27-31). The metal flow rate through the bed may be

increased while maintaining efficiency of filtration, and the release of inclusions from the bed during surges of the metal flow rate may be limited (page 4, lines 2-6).

The invention thus provides an ability to increase filtration rates while improving the purification rate, and thus can improve productivity, reduce the size of filtration facilities, reduce consumption of filtering medium and reduce costs. Moreover, the use of corundum reduces costs as this filtering material is less expensive than tabular alumina (page 5, lines 14-20), and is easier to recycle (page 5, lines 21-29).

VI. ISSUES

The issues on appeal are:

1) Whether claims 1, 2, 4, 6 and 9 are obvious under 35 USC 103(a) over Pryor (US 4,413,813) in view of Japanese publication JP 07-016698A and Robyn et al (US 5,229,337).

2) Whether claims 3 and 11 are obvious under 35 USC 103(a) over Pryor (US 4,413,813) in view of Japanese publication JP 07-016698A and Robyn et al (US 5,229,337) and further in view of Brezny (US 5,322,821).

3) Whether claims 1, 4, 5, 7 and 9 are obvious under 35 USC 103(a) over Hess et al (US 3,172,757) in view of Niedhardt et al (US 4,177,235).

VII. GROUPING OF CLAIMS

The claims are to be considered as a single group.

VIII. ARGUMENTS

In the final rejection, claims 1, 2, 4, 6 and 9 stand rejected under 35 USC 103(a) over Pryor (US 4,413,813) in view of Japanese publication JP 07-016698A and Robyn et al (US 5,229,337).

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The Pryor reference has been cited to show that alumina has been used as a granular material in a filter bed for filtering molten metals. This is no more than the state of the art, as Pryor does not disclose or suggest the open porosity as presently claimed.

The Japanese reference discloses a mold structure in which a sand layer forming a cavity is constituted with spherical mullite ceramic grains having a grain diameter less than 0.5 mm and an apparent porosity ≤ 20%.

Robyn et al discloses a process for preparing a thermally insulated lining or cladding on a surface of a refractory wall or furnace or other structure exposed to high temperatures. According to the disclosure at column 10, lines 9 through 12, "the refractory mass formed on the surface of the wall has a total porosity estimated at about 70%, and an apparent porosity, that is the part of the porosity due to the open pores, of approximately 38%."

The Final Office Action takes the position that:

1) Robyn et al teaches that apparent porosity is the same as open porosity at col. 8, lines 43-47;

2) The Japanese reference therefore teaches that the use of mullite grains having an apparent porosity, and therefore open porosity, of less than 20%; and

3) therefore, it would have been obvious to select the material of the Japanese reference for use in the invention of Pryor, since Pryor is concerned with repeat use (col. 5, lines 37-43), and the mullite grains of the Japanese reference have high resistance to destruction in repeat use (paragraphs [0010]-[0012]).

First, it is noted that neither the Japanese patent nor Robyn et al discloses the filtration of molten metal, and

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therefore these references taken together do not disclose or suggest filtering molten metal through a bed of refractory particulate material having the defined open porosity. There is, moreover, no reason why one of ordinary skill in the art would consider these references, not related to filtration, together with the Pryor reference, which is directed to filtration of molten metal.

The Final Office Action makes reference to the Robyn et al patent for the proposition that apparent porosity has the same meaning as open porosity, based upon a statement at column 10, lines 9 through 12 of Robyn et al that "[t]he refractory mass formed on the surface of the wall has a total porosity estimated at about 70%, and an apparent porosity, that is the part of the porosity due to the open pores, of approximately 38%."

Appellants take issue with the allegation that Robyn et al teaches that open porosity *as used in the present specification* and apparent porosity have the same meaning, since Robyn et al *is not a dictionary*, but is only a patent which gives the patentee license to define terms as seen fit. The fact that apparent porosity has been equated with porosity due to open pores for purposes of a fused wall coating in Robyn et al does not mean that apparent porosity is the same as open porosity for the granules of the Japanese reference or for the granules of the claimed invention.

Appellants conducted a review of the Japanese reference to determine what is meant by the term "apparent porosity" as used therein. In this review, Appellants have taken note of paragraph [0049] of the translation of the Japanese reference, which states that "the measuring method of the apparent porosity of JIS R2205-74 refractory brick, water

absorption and specific gravity" was used to measure the physical properties of the backing sand. Appellants have been able to locate a copy of this Japanese Industrial Standard R2205 dated 1992, which has been entered into the record. Even though this Standard was actually published subsequent to the publication of the Japanese reference, Appellants have no reason to believe that it was not the standard in effect for determination of apparent porosity on the publication date the Japanese reference.

According to this Japanese Standard, apparent porosity is calculated by a formula defined in paragraph 5.1:

$$P_o = \frac{W_3 - W_1}{W_3 - W_2} \times 100,$$

where W_1 is mass of dried sample, W_2 is mass in water of a sample saturated with water and W_3 is mass of sample saturated with water.

Appellants have analyzed the above calculation as follows:

If V is the volume of the sample, V' the volume of the grains, V" the volume of the closed pores of the grains, d' the intrinsic density of the grains and d the density of water, then:

$W_1 = (V'-V") \times d'$;

$W_2 = (V'-V") \times d' + (V-V') \times d - V \times d = (V'-V") \times d - V' \times d$ [Archimedes' law]; and

$W_3 = (V'-V") \times d' + (V-V') \times d$,

thus:

$$P_o = \frac{((V'-V") \times d' + (V-V') \times d - ((V'-V") \times d')}{((V'-V") \times d' + (V-V') \times d) - ((V'-V") \times d' + (V-V') \times d - V \times d)}$$

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This equation reduces to

$$P_0 = \frac{(V-V')}{V} \times 100$$

Appellants therefore have shown that what is intended to be measured in paragraph 5.1 is the *relative total open porosity* of the sample, that is the open porosity *between* the grains and the open porosity *within* the grains, as compared to the total volume of the sample.

Thus, it appears that Robyn et al and the Japanese reference are indeed both measuring the same quantity, referred to as *apparent* porosity in both references and *open* porosity by Robyn et al. This measured parameter is not, however, the open porosity which is the basis for the claimed invention, the open porosity *within the grains themselves,* which must be between 5 and 30%.

Appellants note that despite this evidence concerning the standard by which apparent porosity was measured in the Japanese reference, the Advisory Action of April 1, 2005 insists that apparent porosity must be porosity *within* the particles only, based on the machine translation of the reference. No reason is provided, however, either why Appellants analysis of the Japanese standard in incorrect, or why the Japanese reference did not in fact use this standard to measure apparent porosity.

Moreover, with reference to paragraph [0019] of the Japanese reference, it is clear that an apparent porosity exceeding 20% is not desired because the particle strength is too low, and the particles are too easily crushed if one attempts recycling of these particles.

However, Pryor does not suggest recycling filter

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particles. What is taught by Pryor at col. 8, lines 37-43, is that "while, in the preferred embodiment, the bed media is removed after each cast, the bed media may be used for several casts." Pryor does not therefore teach an operation in which the bed is physically removed and recycled, as in the Japanese reference, and in which therefore, a lower porosity would be useful to preserve the particles.

The references taken in combination, do not, therefore, disclose or suggest the use of refractory particles having a open porosity of 5 to 30% as defined in the present specification, for filtration of molten metal. Appellants have shown, however, that use of such particles is particularly advantageous.

The effectiveness of the invention is established by the comparative example set forth on pages 6-9 of the specification. In this comparison, tabular alumina with a porosity of 2.8% and white corundum with a porosity of 10.7% were used to remove inclusions from a liquid aluminum-magnesium alloy. For each size of inclusion, inclusion removal rate was 97-100% for the corundum according to the invention. The removal rate for the tabular alumina was generally much lower, and quite variable.

Figure 2 of the specification shows a comparison of filtering efficiency for the tabular alumina of the prior art (A) and the corundum of the invention (B). The corundum of the invention maintains a high efficiency for residence times from about 20 to 120 seconds. The prior art product starts with much lower efficiency and does not achieve a high efficiency until residence time reaches almost 180 seconds.

The Brezny reference (cited against claims 3 and 11) has been cited to show that it is known to prepare hollow ceramic

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(alumina) beads in the claimed size range. These beads may have open porosity, but there is no disclosure or suggestion that beads having an open porosity of 5 to 30% are advantageous in filtering molten metal.

Turning to the rejection of claims 1, 4, 5, 7 and 9 over Hess et al in view of Neidhardt et al, it is noted that Hess et al has been cited a the teaching of filtering metal through a bed of refractory particulates, which is *not* disclosed as having the same porosity as the particles of the claimed invention.

Neidhardt et al teaches electrofused corundum, to which claims 5, 7 and 9 are directed, and the Final Office Action states that because Neidhardt et al obtains corundum by the same method as that of the Appellants, the particles would inherently have the same porosity as those of the invention. Moreover, the Final Office Action alleges that the pure α-corundum of Neidhardt et al would be useful in the filtration of Hess et al due to its higher melting point and crush resistance.

Appellants dispute the allegation, however, that the presently claimed open porosity is somehow inherent in the product produced by Neidhardt et al. What is actually stated in the specification, at page 3, lines 6-19, is "[a]ccording to the preferred embodiment of the invention, said refractory material is an electrofused corundum obtained by fusing an alumina in an arc oven, followed by a casting process, preferably in moulds, by adjusting the cooling and solidification state in order to obtain the desired open porosity... Crystallization modifiers such as F, B, Y, MgO or SiO_2 may be added for controlling the porosity."

Thus, while electrofused corundum is the preferred

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refractory material according to the invention, the electrofused corundum must be prepared in such a way that the desired open porosity is obtained. There is no disclosure or suggestion in the Neidhardt et al reference that the electrofused corundum should be prepared in a manner that results in an open porosity of 5 to 30%.

In fact, it is only Appellants who teach the advantage of a refractory particles with an open porosity of between 5 and 30%, specifically for the purpose of filtration of molten metal. While it is well known to filter molten metal through refractory particle, none of the cited references even remotely suggests that removal of inclusions can be improved by utilizing refractory particles having an open porosity between 5 and 30%.

Reversal of the rejections of record is respectfully requested.

Respectfully submitted,

Ira J. Schultz
Registration No. 28666

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IX. APPENDIX

The claims on appeal:

1. A filtration method for liquid metal comprising passing said liquid metal through a bed of refractory particulate material formed from grains having an open porosity between 5 and 30%.

2. The filtration method according to claim 1, wherein the liquid metal has a residence time in the particulate material bed greater than 1 sec and less than 500 secs.

3. The filtration method according to claim 1, wherein the porosity substantially stems from pores with a diameter greater than 10 μm.

4. The filtration method according to claim 1, wherein the material has a particle size between 0.2 and 20 mm and the bed has a thickness between 4 and 40 cm.

5. The filtration method according to claim 1, wherein the material is electrofused corundum.

6. The filtration method according to claim 1, wherein the liquid metal is selected from the group consisting of aluminum, magnesium and alloys thereof.

7. The filtration method according to claim 5, wherein the corundum is obtained by method steps comprising electrofusion of alumina, a casting, a cooling and solidification in order to obtain said porosity, a crushing, then a screening process.

9. A filtration device for liquid metal comprising a bed a refractory particulate electrofused corundum formed from grains having an open porosity between 5 and 30%.

11. The filtration method according to claim 3, wherein the porosity substantially stems from pores with a diameter between 10 and 200 μm.

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